LAW OFFICES
SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC
2100 PENNSYLVANIA AVENUE, N.W.
WASHINGTON, DC 20037-3213
TELEPHONE (202) 293-7060
FACSIMILE (202) 293-7860
www.sughrue.com

March 16, 2001

BOX PCT
Commissioner for Patents
Washington, D.C. 20231

PCT/JP99/03830
-filed July 16, 1999

Re: Application of Akihiro GOTO and Toshio MORO
ELECTRODE FOR ELECTRIC DISCHARGE SURFACE TREATMENT AND MANUFACTURING METHOD THEREOF
Our Ref: Q63491

Dear Sir:

The following documents and fees are submitted herewith in connection with the above application for the purpose of entering the National stage under 35 U.S.C. § 371 and in accordance with Chapter I of the Patent Cooperation Treaty:

- ☑ an executed Declaration and Power of Attorney.
- ☑ an English translation of the International Application.
- ☑ three (3) sheets of drawings.
- ☑ an executed Assignment and PTO 1595 form.
- ☑ a Form PTO-1449 listing the ISR references, and a complete copy of each reference.
- ☑ a Preliminary Amendment

It is assumed that copies of the International Application, the International Search Report, the International Preliminary Examination Report, and any Articles 19 and 34 amendments as required by § 371(c) will be supplied directly by the International Bureau, but if further copies are needed, the undersigned can easily provide them upon request.

The Government filing fee is calculated as follows:

Total claims	6	-	20	=		x	$18.00	= $.00
Independent claims	2	-	3	=		x	$80.00	= $.00
Base Fee								$860.00
TOTAL FILING FEE								$860.00
Recordation of Assignment								$ 40.00
TOTAL FEE								$900.00

Checks for the statutory filing fee of $860.00 and Assignment recordation fee of $40.00 are attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§ 1.16, 1.17 and 1.492 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A duplicate copy of this transmittal letter is attached.

There is no claim to priority.

Respectfully submitted,

Paul E. Mexic Reg. 33,102

Darryl Mexic
Registration No. 23,063

DM:rwl

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Akihiro GOTO et al.

Appln. No.: Not Yet Assigned

Group Art Unit: Not Yet Assigned

Confirmation No.: Not Yet Assigned

Examiner: Not Yet Assigned

Filed: March 16, 2001

For: ELECTRODE FOR ELECTRIC DISCHARGE SURFACE TREATMENT AND MANUFACTURING METHOD THEREOF

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Page 7-8, please delete the BRIEF DESCRIPTION OF THE DRAWINGS and replace it with the following new one:

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1(a) and 1(b) are illustrations showing an electrode for electric discharge surface treatment and a manufacturing method thereof according to this invention.

Fig. 2 is an illustration showing a configuration example of an electric discharge surface treatment apparatus using the electrode for electric discharge surface treatment according to the invention.

Fig. 3 is an illustration showing a configuration example of an electric discharge surface treatment apparatus using a conventional electrode for electric discharge surface treatment.

REMARKS

Entry and consideration of this Amendment is respectfully requested.

Respectfully submitted,

Darryl Mexic
Registration No. 23,063

SUGHRUE, MION, ZINN,
MACPEAK & SEAS, PLLC
2100 Pennsylvania Avenue, N.W.
Washington, D.C. 20037-3213
Telephone: (202) 293-7060
Facsimile: (202) 293-7860
DM:rwl
Q63491
Date: March 16, 2001

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The specification is changed as follows:

Page 7-8, BRIEF DESCRIPTION OF THE DRAWINGS

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1(a) and 1(b) are~~is an~~ illustrations showing an electrode for electric discharge surface treatment and a manufacturing method thereof according to this invention.

Fig. 2 is an illustration showing a configuration example of an electric discharge surface treatment apparatus using the electrode for electric discharge surface treatment according to the invention.

Fig. 3 is an illustration showing a configuration example of an electric discharge surface treatment apparatus using a conventional electrode for electric discharge surface treatment.

Description

Electrode for Electric Discharge Surface Treatment and Manufacturing Method Thereof

Technical Field

This invention relates to improvements in an electrode for electric discharge surface treatment and a manufacturing method thereof used in electric discharge surface treatment operations for forming a hard coating made of an electrode material on the surface of a treated material or a hard coating made of a substance in which the electrode material reacts by electric discharge energy through the energy by generating electric discharge between the electrode and the treated material.

Background Art

Conventionally, as a technique of forming a hard coating on the surface of a treated material to provide corrosion resistance or abrasion resistance, there is an electric discharge surface treatment method disclosed in, for example, JP-A-5-148615. This technique is an electric discharge surface treatment method of a metal material comprising two steps of performing primary processing (deposition processing) using a green compact electrode obtained by mixing a WC (tungsten carbide) powder and a Co (cobalt) powder to perform compression molding and

then performing secondary processing (remelting processing) by replacing the green compact electrode with an electrode with relatively small electrode consumption such as a copper electrode. In this method, a hard coating having strong adhesion strength to a steel material can be formed, but it is difficult to form a hard coating having strong adhesion strength to a sinter material such as cemented carbide.

However, according to our research, it has been found that when a material for forming hard carbide such as Ti (titanium) is used as an electrode and electric discharge is generated between the electrode and a metal material which is a treated material, a strong hard coating can be formed on the surface of the metal which is the treated material without a process of remelting. This is because carbon which is a component in processing liquid reacts with the electrode material consumed by the electric discharge to form TiC (titanium carbide). Also, it has been found that when by a green compact electrode of metal hydride such as TiH_2 (titanium hydride), electric discharge is generated between the electrode and a metal material which is a treated material, a hard coating with the adhesion higher than that of the case of using a material such as Ti can speedily be formed. Further, it has been found that when by a green compact electrode in which other metals or ceramics are mixed with the hydride such as TiH_2, electric discharge is generated between the electrode and a metal material which

is a treated material, a hard coating with various properties such as hardness or abrasion resistance can speedily be formed.

Such a method is disclosed in, for example, JP-A-9-192937, and a configuration example of an apparatus used in such electric discharge surface treatment will be described by way of Fig. 3. In the drawing, numeral 1 is a green compact electrode obtained by compressedly molding a TiH_2 powder, and numeral 2 is a treated material, and numeral 3 is a processing bath, and numeral 4 is a processing liquid, and numeral 5 is a switching element for performing switching of voltage and current applied to the green compact electrode 1 and the treated material 2, and numeral 6 is a control circuit for performing on-off control of the switching element 5, and numeral 7 is a power source, and numeral 8 is a resistor, and numeral 9 is a hard coating formed. By such a configuration, the hard coating 9 having strong adhesion strength can be formed on the surface of the treated material 2 such as steel or cemented carbide through electric discharge energy by generating electric discharge between the green compact electrode 1 and the treated material 2.

There is a problem in that an electrode used in such electric discharge surface treatment is difficult to handle unless the electrode has a certain degree of strength and also the electrode crumbles excessively by electric discharge energy at the time of the electric discharge surface treatment and the electrode

material cannot adhere to the surface of the treated material in a state of melting. Also, in case that the strength of the electrode is high and the electrode hardens excessively, there is a problem in that the electrode is difficult to crumble by electric discharge energy at the time of the electric discharge surface treatment and processing efficiency reduces. Thus, the electrode for electric discharge surface treatment requires moderate strength and crumbliness. As a material having such properties, metal hydride is given, but since there is danger of spontaneous combustion in case that the metal hydride touches at water, there is a problem in a safety standpoint. Therefore, a practical electrode for electric discharge surface treatment including the metal hydride in the electrode material cannot be obtained.

Disclosure of the Invention

This invention is implemented to solve the problems, and an object of the invention is to obtain a practical electrode for electric discharge surface treatment and a manufacturing method thereof capable of reducing manufacturing costs while improving processing efficiency of electric discharge surface treatment and having superior safety.

With an electrode for electric discharge surface treatment according to a first invention, in the electrode for electric discharge surface treatment used in electric discharge surface

treatment for forming a hard coating on the surface of a treated material through the energy by generating electric discharge between the electrode and the treated material, at least a powder of metal carbide and a powder of metal hydride are mixed and heating treatment is performed after compression molding and hydrogen in the metal hydride is desorbed to be formed.

With an electrode for electric discharge surface treatment according to a second invention, in the first invention, the metal carbide is titanium carbide and the metal hydride is titanium hydride.

With an electrode for electric discharge surface treatment according to a third invention, in the first invention, a mixture ratio of the powder of the metal carbide to the powder of the metal hydride is set according to desired electrode strength and crumbliness.

With a manufacturing method of an electrode for electric discharge surface treatment according to a fourth invention, in the manufacturing method of an electrode for electric discharge surface treatment used in electric discharge surface treatment for forming a hard coating on the surface of a treated material through the energy by generating electric discharge between the electrode and the treated material, at least a powder of metal carbide and a powder of metal hydride are mixed and heating treatment is performed after compression molding and hydrogen in the metal hydride is desorbed to manufacture the

electrode for electric discharge surface treatment.

With a manufacturing method of an electrode for electric discharge surface treatment according to a fifth invention, in the fourth invention, the metal carbide is titanium carbide and the metal hydride is titanium hydride.

With a manufacturing method of an electrode for electric discharge surface treatment according to a sixth invention, in the fourth invention, a mixture ratio of the powder of the metal carbide to the powder of the metal hydride is set according to desired electrode strength and crumbliness.

This invention has the following effects since the invention is constructed as described above.

An electrode for electric discharge surface treatment according to the first invention and the second invention has an effect of providing a low cost and superior safety. Also, in electric discharge surface treatment using this electrode for electric discharge surface treatment, there is an effect capable of improving processing efficiency while forming a good hard coating on the treated material.

An electrode for electric discharge surface treatment according to the third invention has an effect similar to that of the first invention, and also the electrode for electric discharge surface treatment having strength and crumbliness of the electrode suitable for desired electric discharge surface treatment characteristics can be obtained, and in electric

discharge surface treatment using this electrode for electric discharge surface treatment, there is an effect capable of forming a good hard coating according to characteristics of the treated material.

A manufacturing method of an electrode for electric discharge surface treatment according to the fourth invention and the fifth invention has an effect capable of stably supplying an electrode for electric discharge surface treatment with a low cost and superior safety. Also, in electric discharge surface treatment using the electrode for electric discharge surface treatment manufactured by this manufacturing method, there is an effect capable of improving processing efficiency while forming a good hard coating on the treated material.

A manufacturing method of an electrode for electric discharge surface treatment according to the sixth invention has an effect similar to that of the fourth invention, and also the electrode for electric discharge surface treatment having strength and crumbliness of the electrode suitable for desired electric discharge surface treatment characteristics can be manufactured, and in electric discharge surface treatment using this electrode for electric discharge surface treatment, there is an effect capable of forming a good hard coating according to characteristics of the treated material.

Brief Description of the Drawings

Fig. 1 is an illustration showing an electrode for electric discharge surface treatment and a manufacturing method thereof according to this invention.

Fig. 2 is an illustration showing a configuration example of an electric discharge surface treatment apparatus using the electrode for electric discharge surface treatment according to the invention.

Fig. 3 is an illustration showing a configuration example of an electric discharge surface treatment apparatus using a conventional electrode for electric discharge surface treatment.

Best Mode for Carrying Out the Invention

As shown in the background art, an electrode for electric discharge surface treatment requires moderate strength and crumbliness and in metal hydride which is a material having such properties, there is a problem in a safety standpoint. Thus, it is necessary to manufacture an electrode made of a material having strength and crumbliness suitable for an electrode for electric discharge surface treatment similar to the metal hydride and no problem in the safety standpoint. According to experiments performed on various materials for this purpose, it has been found that the strength of a green compact electrode in which a powder is compressedly molded has a close relation to hardness of the powder. That is, when the

powder has high hardness (for example, metal carbide etc.), a shape of the powder is difficult to change even when performing compression molding, so that the molding is difficult or there is a property of becoming brittle even when the molding is possible. Also, when the powder has low hardness (for example, powder of metal single etc.), the powder deforms easily when performing compression molding, so that there is a property of hardening strongly.

Therefore, it has been found that an electrode for electric discharge surface treatment having desired strength and crumbliness can be obtained by mixing powders with different hardness at a predetermined mixture ratio to perform compression molding.

Next, a case of manufacturing an electrode by mixing a TiC powder which is metal carbide (high hardness) and a Ti powder which is a metal single (low hardness) as powders with different hardness to perform compression molding will be described as one example. As an electrode for electric discharge surface treatment, it is necessary to make a particle diameter of the electrode material powders to approximately 10 μm or less in order to improve electric discharge characteristics in electric discharge surface treatment, but since Ti is a sticky material, it is difficult to decrease the particle diameter of the Ti powder. That is, in order to grind the powder, an apparatus called a ball mill for putting the powder and balls of ceramics

into a cylindrical vessel to rotate them is generally used, but in the case of the Ti powder even using such an apparatus, since Ti is a sticky material, a deformation of the powder occurs, but fineness of the powder does not proceed too much. Thus, in the case that the electrode material is the Ti powder, since fineness of a particle diameter of the electrode material powder suitable for the electrode for electric discharge surface treatment requires extremely high manufacturing costs, a practical electrode for electric discharge surface treatment cannot be obtained.

Therefore, it is important to select electrode materials capable of mixing powders with different hardness at a predetermined mixture ratio in order to provide desired strength and crumbliness to the electrode for electric discharge surface treatment and also performing fineness of a particle diameter of these powders at practical manufacturing costs. An illustration of an electrode for electric discharge surface treatment and a manufacturing method thereof according to this invention using the electrode materials selected from such a viewpoint is shown in Fig. 1. In the drawing, numeral 10 is an electrode for electric discharge surface treatment according to this invention, and numeral 11 is a TiC powder which is a metal carbide powder, and numeral 12 is a TiH_2 powder which is a metal hydride powder, and numeral 13 is a Ti powder which is a metal single powder. Also, Fig. 2 is one example of an

electric discharge surface treatment apparatus constructed using the electrode for electric discharge surface treatment according to this invention, and in the drawing, numeral 2 is a treated material, and numeral 3 is a processing bath, and numeral 4 is a processing liquid, and numeral 5 is a switching element for performing switching of voltage and current applied to interelectrode, and numeral 6 is a control circuit for performing on-off control of the switching element 5, and numeral 7 is a power source, and numeral 8 is a resistor, and numeral 10 is an electrode for electric discharge surface treatment according to this invention, and numeral 14 is a hard coating formed on the treated material 2. By such a configuration, the hard coating 14 having strong adhesion strength can be formed on the surface of the treated material 2 through electric discharge energy by generating electric discharge between the electrode 10 for electric discharge surface treatment and the treated material 2.

In Fig. 1A, the TiC powder 11 is a material of high hardness and the TiH_2 powder 12 is a material of low hardness. As described above, strength and crumbliness of the electrode can be adjusted by a mixture ratio of these powders. By experiment, it has been found that compression molding can be performed at a mixture ratio of the TiC powder 11 to the TiH_2 powder 12 with the range approximately from 1:9 to 9:1 and strength of a green compact increases with an increase in the mixture ratio of the TiH_2

powder 12. Therefore, by changing a mixture ratio of this metal carbide powder to the metal hydride powder, the strength of the green compact can be changed and thus the strength and crumbliness of the electrode can be changed.

Also, the compression molding can be performed by putting the mixed powders which are the electrode materials into a metal mold and applying a pressure with a press and so on.

By forming the green compact made of the TiC powder 11 which is the metal carbide powder and the TiH_2 powder 12 which is the metal hydride powder in this manner, a reduction (1 μm to 3 μm or less) in the particle diameter is facilitated. This is because the TiC is easy to manufacture a fine powder industrially and also it is possible to grind the TiH_2 very easily. For example, when the TiC powder with a small particle diameter and the TiH_2 powder with a large particle diameter are mixed and grinding treatment of the powders is performed by the ball mill, the TiH_2 powder becomes fine and the mixed powders of TiC and TiH_2 with the small particle diameter can be obtained. In this manner, the powders with the small particle diameter can easily be formed, so that manufacturing costs of the powders can be reduced.

However, when the powders remain this state, the powders are low in strength and tend to crumble for use in an electrode for electric discharge surface treatment. Also, there is danger of spontaneous combustion by including titanium hydride. Thus,

by mixing the TiC powder and the TiH_2 powder at a predetermined mixture ratio and performing heating treatment of the green compact (Fig. 1A) obtained by compression molding and decomposing the TiH_2 to desorb hydrogen and making metal Ti, a practical electrode 10 for electric discharge surface treatment (Fig. 1B) having moderate strength and crumbliness as well as safety can be obtained.

The heating treatment can be performed, for example, by applying high-frequency heating to the green compact of Fig. 1A in an electric furnace.

By such a manufacturing method, processing efficiency of electric discharge surface treatment can be improved, and a low-cost electrode for electric discharge surface treatment with superior safety can stably be supplied.

In the above description, the case of using the TiC powder as a metal carbide powder and the TiH_2 powder as a metal hydride powder has been shown, but similar effects are obtained even when using other metal carbide powders and metal hydride powders.

Industrial Applicability

As described above, an electrode for electric discharge surface treatment according to this invention is suitable for use in electric discharge surface treatment operations. Also, a manufacturing method of the electrode for electric discharge surface treatment according to this invention is suitable for

manufacture of the electrode for electric discharge surface treatment.

Claims

1. An electrode for electric discharge surface treatment used in electric discharge surface treatment for forming a hard coating on the surface of a treated material through the energy by generating electric discharge between the electrode and the treated material, characterized by mixing at least a powder of metal carbide and a powder of metal hydride and performing heating treatment after compression molding and desorbing hydrogen in the metal hydride to be formed.

2. An electrode for electric discharge surface treatment as defined in claim 1, characterized in that the metal carbide is titanium carbide and the metal hydride is titanium hydride.

3. An electrode for electric discharge surface treatment as defined in claim 1, characterized in that a mixture ratio of the powder of the metal carbide to the powder of the metal hydride is set according to desired electrode strength and crumbliness.

4. A manufacturing method of an electrode for electric discharge surface treatment used in electric discharge surface treatment for forming a hard coating on the surface of a treated material through the energy by generating electric discharge between the electrode and the treated material, characterized by mixing at least a powder of metal carbide and a powder of metal hydride and performing heating treatment after compression molding and desorbing hydrogen in the metal hydride to manufacture the electrode for electric discharge surface

treatment.

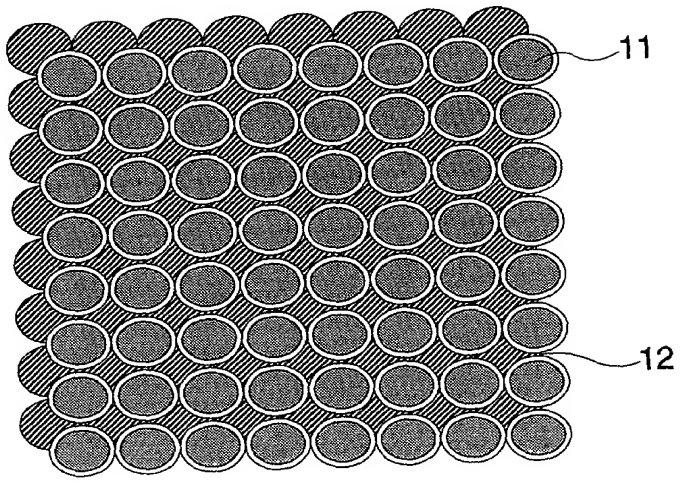
5. A manufacturing method of an electrode for electric discharge surface treatment as defined in claim 4, characterized in that the metal carbide is titanium carbide and the metal hydride is titanium hydride.

6. A manufacturing method of an electrode for electric discharge surface treatment as defined in claim 4, characterized in that a mixture ratio of the powder of the metal carbide to the powder of the metal hydride is set according to desired electrode strength and crumbliness.

Abstract

In an electrode for electric discharge surface treatment used in electric discharge surface treatment for forming a hard coating on the surface of a treated material through the energy by generating electric discharge between the electrode and the treated material, a TiC powder (11) which is metal carbide and a TiH_2 powder (12) which is metal hydride are mixed and heating treatment is performed after compression molding and hydrogen in the TiH_2 powder (12) is desorbed to make a Ti powder (13) and a practical electrode (10) for electric discharge surface treatment having moderate strength and crumbliness as well as safety is formed.

FIG. 1(a)



HEAT
TREATMENT

FIG. 1(b)

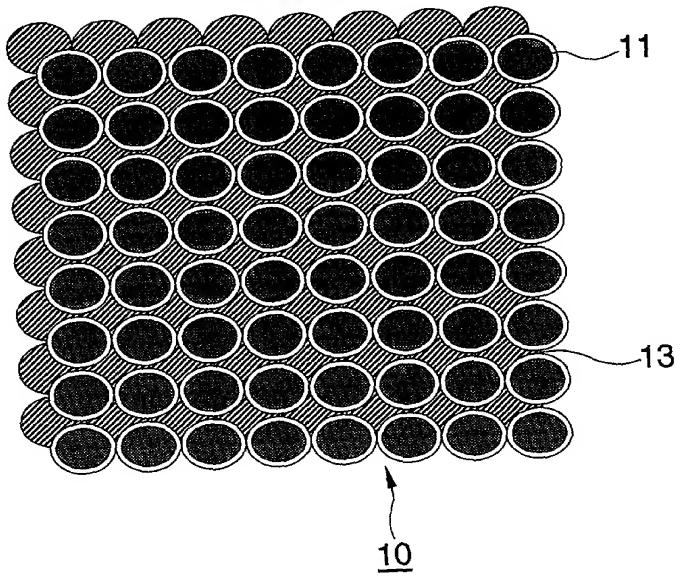


FIG. 2

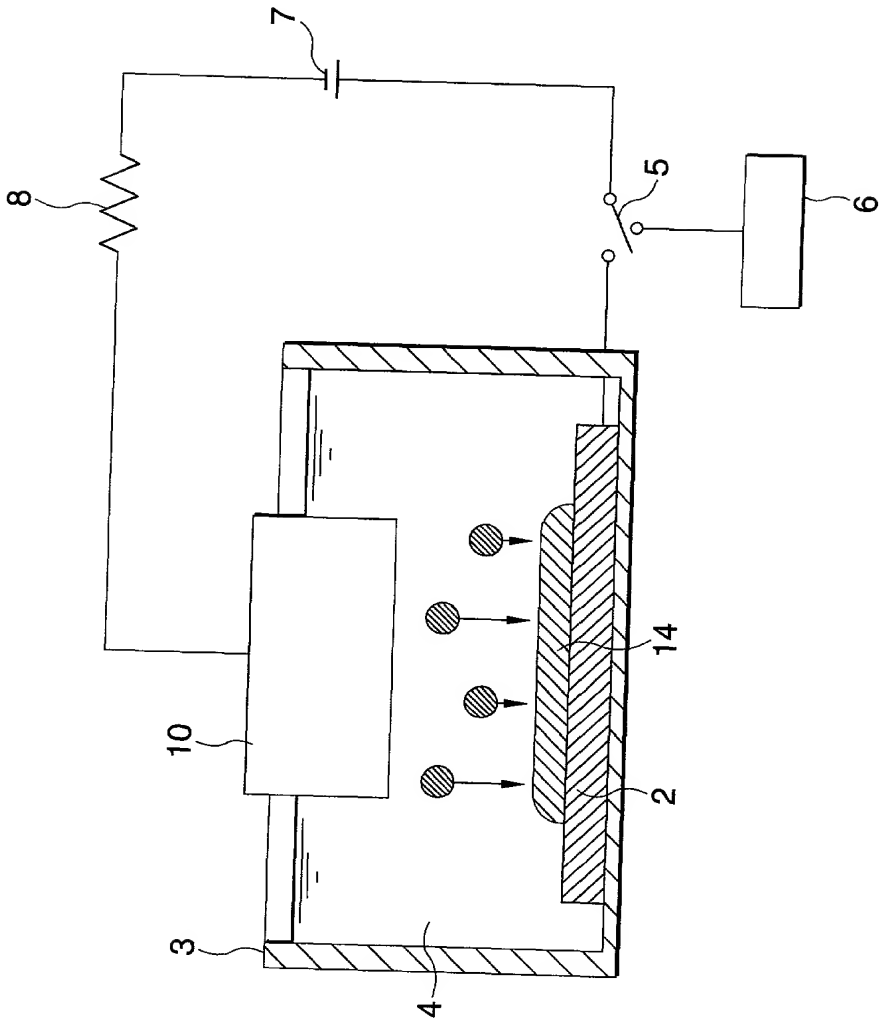


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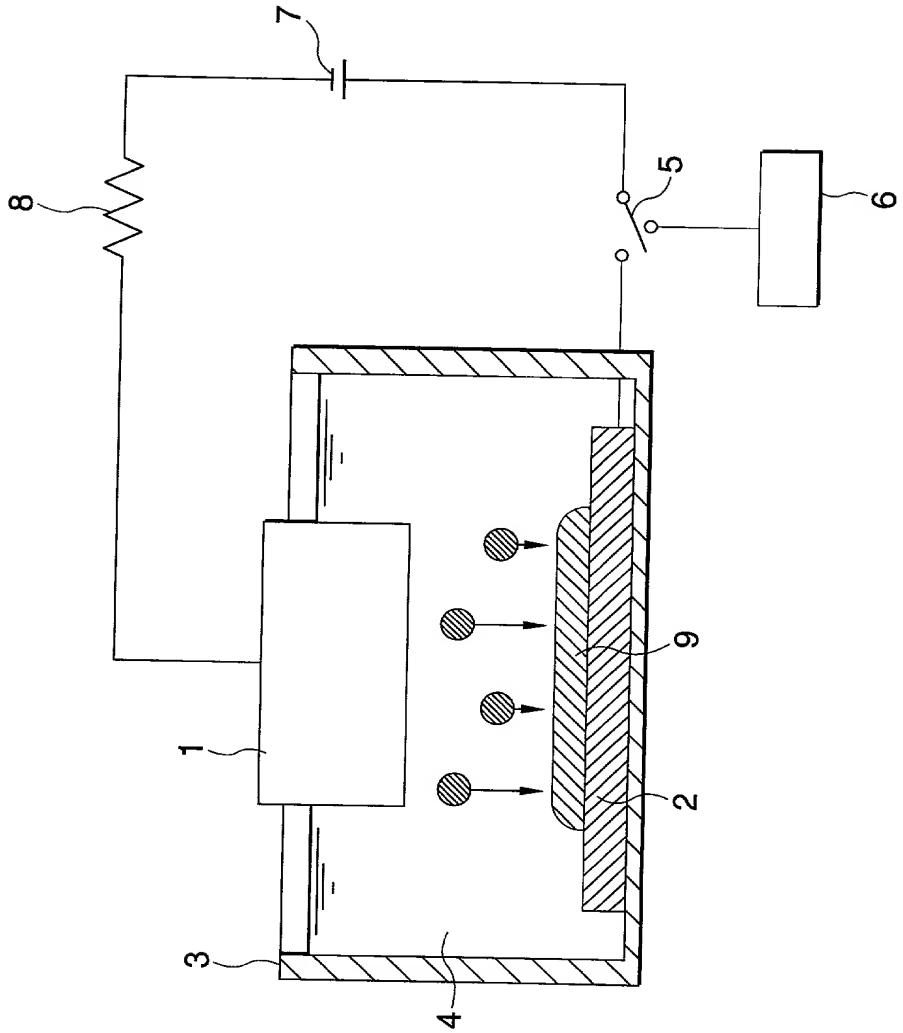
FIG. 3



Declaration and Power of Attorney for Patent Application

特許出願宣言書及び委任状

Japanese Language Declaration

日本語宣言書

下記の氏名の発明者として、私は以下の通り宣言します。

As a below named inventor, I hereby declare that:

私の住所、私書箱、国籍は下記の私の氏名の後に記載された通りです。

My residence, post office address and citizenship are as stated next to my name,

下記の名称の発明に関して請求範囲に記載され、特許出願している発明内容について、私が最初かつ唯一の発明者(下記の氏名が一つの場合)もしくは最初かつ共同発明者であると(下記の名称が複数の場合)信じています。

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

ELECTRODE FOR ELECTRIC DISCHARGE SURFACE TREATMENT AND MANUFACTURING METHOD THEREOF

上記発明の明細書(下記の欄でX印がついていない場合は、本書に添付)は、

the specification of which is attached hereto unless the following box is checked:

～ ___月___日に提出され、米国出願番号または特許協定条約

国際出願番号を _____ とし、

(該当する場合) _____ に訂正されました。

～ was filed on _____
as United States Application Number or
PCT International Application Number

_____ and was amended on

_____ (if applicable).

私は、特許請求範囲を含む上記訂正後の明細書を検討し、内容を理解していることをここに表明します。

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

私は、連邦規則法典第37編第1条56項に定義されるとおり、特許資格の有無について重要な情報を開示する義務があることを認めます。

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

Japanese Language Declaration

(日本語宣言書)

私は、米国法典第35編第119条(a)-(d)項又は第365条(b)項に基き下記の、米国以外の国の少なくとも一カ国を指定している特許協力条約第365条(a)項に基づく国際出願、又は外国での特許出願もしくは発明者証の出願についての外国優先権をここに主張するとともに、優先権を主張している本出願の前に出願された特許または発明者証の外国出願を以下に、枠内をマークすることで、示しています。

I hereby claim foreign priority under Title 35, United States Code, Section 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Applications 外国での先行出願			Priority Not Claimed 優先権主張なし
(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)	☐
(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)	☐
(Number) (番号)	(Country) (国名)	(Day/Month/Year Filed) (出願年月日)	☐

私は、第35編米国法典119条(e)項に基づいて下記の米国特許出願規定に記載された権利をここに主張致します。

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below.

(Application No.) (出願番号)	(Filing Date) (出願日)	(Application No.) (出願番号)	(Filing Date) (出願日)

私は、下記の米国法典第35編第120条に基づいて下記の米国特許出願に記載された権利、又は米国を指定している特許協力条約第365条(c)に基づく権利をここに主張します。又、本出願の各請求範囲の内容が米国法典第35編第112条第1項又は特許協力条約で規定された方法で先行する米国特許出願に開示されていない限り、その先行米国出願書提出日以降で本出願書の日本国内又は特許協力条約国際出願提出日までの期間中に入手された、連邦規則法典第37編第1条第56項で定義された特許資格の有無に関する重要な情報について開示義務があることを認識しています。

I hereby claim the benefit of Title 35, United States Code Section 120 of any United States application(s), or 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose any material information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application No.) (出願番号)	(Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況: 特許許可済、係属中、放棄済)
(Application No.) (出願番号)	(Filing Date) (出願日)	(Status: Patented, Pending, Abandoned) (現況: 特許許可済、係属中、放棄済)

私は、私自身の知識に基づいて本宣言中で私が行う表明が真実であり、かつ私の入手した情報と私の信ずるところに基づく表明が全て真実であると信じていること、さらに故意になされた虚偽の表明及びそれと同等の行為は米国法典第18編第1001条に基づき、罰金または拘禁、もしくはその両方により処罰されること、そしてそのような故意による虚偽の声明を行えば、出願した、又は既に許可された特許の有効性が失われることを認識し、よってここに上記のごとく宣誓を致します。

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Japanese Language Declaration

（日本語宣言書）

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(29)

John H. Mion, Reg. No. 18,879; Thomas J. Macpeak, Reg. No. 19,292; Robert J. Seas, Jr., Reg. No. 21,092; Darryl Mexic, Reg. No. 23,063; Robert V. Sloan, Reg. No. 22,775; Peter D. Olexy, Reg. No. 24,513; J. Frank Osha, Reg. No. 24,625; Waddell A. Biggart, Reg. No. 24,861; Louis Gubinsky, Reg. No. 24,835; Neil B. Siegel, Reg. No. 25,200; David J. Cushing, Reg. No. 28,703; John R. Inge, Reg. No. 26,916; Joseph J. Ruch, Jr., Reg. No. 26,577; Sheldon I. Landsman, Reg. No. 25,430; Richard C. Turner, Reg. No. 29,710; Howard L. Bernstein, Reg. No. 25,665; Alan J. Kasper, Reg. No. 25,426; Kenneth J. Burchfiel, Reg. No. 31,333; Gordon Kit, Reg. No. 30,764; Susan J. Mack, Reg. No. 30,951; Frank L. Bernstein, Reg. No. 31,484; Mark Boland, Reg. No. 32,197; William H. Mandir, Reg. No. 32,156; Scott M. Daniels, Reg. No. 32,562; Brian W. Hannon, Reg. No. 32,778; Abraham J. Rosner, Reg. No. 33,276; Bruce E. Kramer, Reg. No. 33,725; Paul F. Neils, Reg. No. 33,102 and Brett S. Sylvester, Reg. No. 32,765

書類送付先：

Send Correspondence to:

SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC
2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037-3202

直通電話連絡先：（名称及び電話番号）

Direct Telephone Calls to: (*name and telephone number*)

(202)293-7060

唯一又は第一発明者名 1-00	Full name of sole or first inventor Akihiro GOTO
発明者の署名 日付	Inventor's signature Date Akihiro Goto March 2, 2001
住所	Residence Tokyo, Japan JPX
国籍	Citizenship Japan
郵便の宛先	Post office address c/o Mitsubishi Denki Kabushiki Kaisha, 2-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100-8310, Japan
第二共同発明者名（該当する場合） 2-00	Full name of second joint inventor, if any Toshio MORO
第二発明者の署名 日付	Second inventor's signature Date Toshio Moro March 2, 2001
住所	Residence Tokyo, Japan JPX
国籍	Citizenship Japan
郵便の宛先	Post office address c/o Mitsubishi Denki Kabushiki Kaisha, 2-3, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100-8310, Japan

（第三以降の共同発明者についても同様に記載し、署名をすること。）

(Supply similar information and signature for third and subsequent joint inventors.)